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मानक

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“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

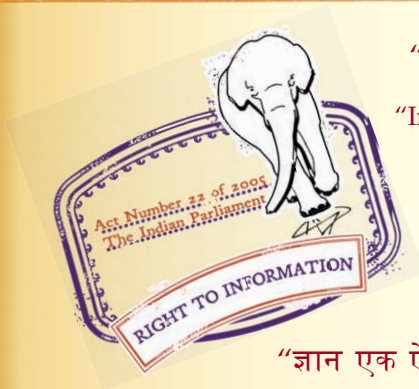
“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 13547-2 (2010): Manipulating Industrial Robots - Mechanical Interfaces, Part 2: Shafts [PGD 18: Industrial and Production Automation Systems and Robotics]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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IS 13547 (Part 2) : 2010
ISO 9409-2 : 2002

भारतीय मानक
औद्योगिक रोबोट को चलाने की युक्ति — यांत्रिक इंटरफेस
भाग 2 शाफ्ट
(पहला पुनरीक्षण)

Indian Standard
MANIPULATING INDUSTRIAL ROBOTS —
MECHANICAL INTERFACES
PART 2 SHAFTS
(*First Revision*)

ICS 25.040.30

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

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NATIONAL FOREWORD

This Indian Standard (Part 2) (First Revision) which is identical with ISO 9409-2 : 2002 'Manipulating industrial robots — Mechanical interfaces — Part 2: Shaft' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Industrial and Production Automation Systems and Robotics Sectional Committee and approval of the Production and General Engineering Division Council.

This standard was originally published in 2003 based on ISO 9409-2 : 1996 'Manipulating industrial robots — Mechanical interfaces — Part 2: Shafts (form A)'. This first revision has been harmonized with ISO 9409-2 : 2002 by adoption to make pace with the latest developments taken place at international level. This standard consists of two parts. The other part is as under:

Part 1 Plates

The text of ISO Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain terminology and conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

- a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.
- b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their respective places are listed below along with their degree of equivalence for the editions indicated:

<i>International Standard</i>	<i>Corresponding Indian Standard</i>	<i>Degree of Equivalence</i>
ISO 286 -1 : 1988 ISO system of limits and fits — Part 1: Bases of tolerances, deviations and fits	IS 919 (Part 1) : 1993 ISO system of limits and fits: Part 1 Bases of tolerances, deviations and fits (<i>second revision</i>)	Identical
ISO 286 -2 : 1988 ISO system of limits and fits — Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts	IS 919 (Part 2) : 1993 ISO system of limits and fits: Part 2 Tables of standard tolerance grades and limit deviations for holes and shafts (<i>first revision</i>)	do
ISO 1101 : 1983 ¹⁾ Technical drawings — Geometrical tolerancing — Tolerancing of form, orientation, location and run-out — Generalities, definitions, symbols, indications on drawings	IS 8000 (Part 1) : 1985 Geometrical tolerancing on technical drawings: Part 1 Tolerancing of form, orientation, location and run-out, and appropriate geometrical definitions (<i>first revision</i>)	do
ISO 8373 : 1994 Manipulating industrial robots — Vocabulary	IS 14662 : 1999 Manipulating industrial robots — Vocabulary	do

¹⁾ Since revised in 2004.

Indian Standard

**MANIPULATING INDUSTRIAL ROBOTS —
MECHANICAL INTERFACES**

PART 2 SHAFTS

(First Revision)

1 Scope

This part of ISO 9409 defines the main dimensions, designation and marking for a shaft with cylindrical projection as mechanical interface. It is intended to ensure the exchangeability and to keep the orientation of hand-mounted end effectors.

This part of ISO 9409 does not contain any correlation of load-carrying ranges.

The mechanical interfaces specified in this part of ISO 9409 will also find application in simple handling systems which are not covered by the definition of manipulating industrial robots, such as pick-and-place or master-slave units.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 9409. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 9409 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 286-1:1988, *ISO system of limits and fits — Part 1: Bases of tolerances, deviations and fits*

ISO 286-2:1988, *ISO system of limits and fits — Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts*

ISO 1101:—¹⁾, *Geometrical Product Specifications (GPS) — Geometrical tolerancing — Tolerances of form, orientation, location and run-out*

ISO 8373:1994, *Manipulating industrial robots — Vocabulary*

ISO 9409-1:1996, *Manipulating industrial robots — Mechanical interfaces — Part 1: Plates (form A)*

ISO 9787:1999, *Manipulating industrial robots — Coordinate systems and motion nomenclatures*

3 Terms and definitions

For the purposes of this part of ISO 9409, the terms and definitions given in ISO 8373 apply.

1) To be published. (Revision of ISO 1101:1983)

4 Dimensions

4.1 General

It is recommended that the dimensions for a shaft with cylindrical projection as mechanical interface be specified in accordance with Figure 1 and Table 1 (Type 1, without a slot for end effector orientation) or Figure 2 and Table 2 (Type 2, with a slot for end effector orientation).

It is recommended that series 1 dimensions be used. The supplementary series 2 shall be used only in special applications where series 1 dimensions are not suitable for the intended use.

The reference plane is defined as shown in Figures 1 and 2. The end effectors are positioned against the reference plane (see the note in clause 5).

4.2 Coordinate system

The origin of the mechanical interface coordinate system as defined in ISO 9787 is the intersecting point of the centre axis of the shaft and the reference plane.

The $+Z_m$ axis points away from the origin towards the end of the shaft.

The flat surface and the slot (optional) is aligned to the $+X_m$ axis as shown in Figures 1 and 2. The flat surface is a place where a set screw is seated to fix an end effector. The slot is used for mating a pin mounted on an end effector to maintain end-effector orientation (see clause 5).

4.3 Tolerances

The mechanical interface dimensions shall be toleranced in accordance with ISO 286. Geometric tolerances shall be interpreted in accordance with ISO 1101. The shaft diameter, d_1 , shall be the datum for all geometrical tolerances (see Figures 1 and 2).

4.4 Load-carrying capacity and shaft material

The mechanical interface of the shaft specified in this part of ISO 9409 is suitable for robots of relatively small load capacity and for applications where end effectors are expected to move with narrow clearance between peripherals.

The use of a plate as mechanical interface (ISO 9409-1) is recommended when a shaft is not sufficient for bearing expected loads.

5 End effector requirements

The dimensions and related tolerances of the mating surface of the end effector shall be compatible with those specified in this part of ISO 9409.

The slot on the interface, $b \times l_5$ (optional; see Figure 2 and Table 2), is intended for mating a location pin mounted on an end effector to maintain end effector orientation. A parallel (cylindrical) pin is recommended for this purpose. The pin axis shall be aligned to the $+X_m$ axis.

The shaft, $d_1 \times l_1$, shall be of sufficient length and strength to bear an end effector coupled with friction, for example an end effector attached by clamping.

The threaded hole on the shaft end can be used to fix end effectors.

NOTE The shaft end should not be used as a dimensional reference; the end effectors should be positioned against the reference plane.

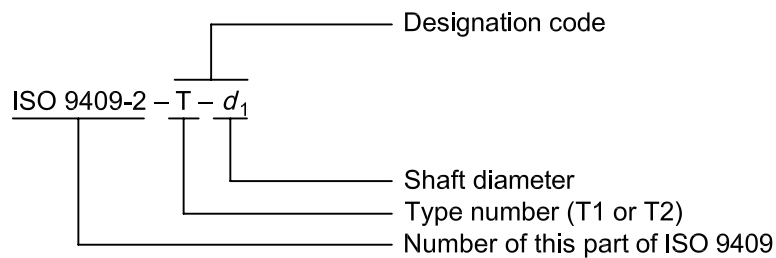
6 Recommended practices — Provisions for routing service lines

A threaded hole can be made as a through hole for cabling or piping, or for exhausting surrounding air.

If the shaft is provided with a hollow centre, the through hole shall have a diameter, d_4 , equal to or less than the pilot hole diameter of the threaded hole, d_3 .

7 Designation code

The designation of the mechanical interface whose dimensions are in accordance with this part of ISO 9409 shall be as follows:



EXAMPLE A mechanical interface of Type 1 with a shaft diameter, $d_1 = 10$ mm, shall be designated as follows:

ISO 9409-2 – T1 – 10

8 Marking

When the shaft and related end effectors made in accordance with this part of ISO 9409 are marked, they shall be permanently marked with the designation code (see clause 7).

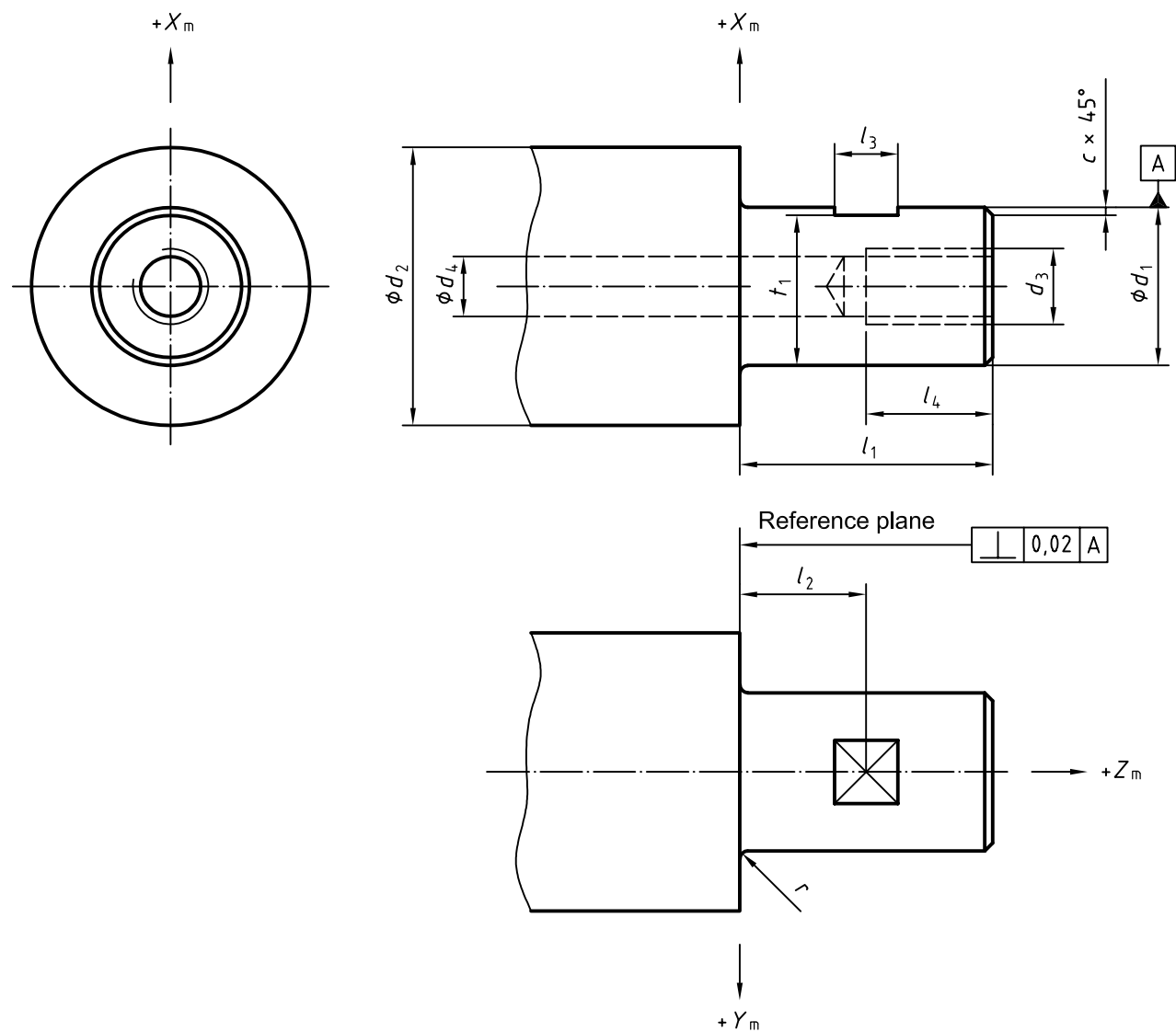


Figure 1 — Basic layout of the shaft mechanical interface Type 1

Table 1 — Preferred series 1 and supplementary series 2 of the shaft mechanical interface Type 1

Shaft diameter		Reference plane diameter	Shaft length	Flat surface			Internal thread		Chamfer	Rounding
				Location	Length	Height	Nominal diameter	Depth		
d_1 h7		d_2	l_1	l_2	l_3	t_1	d_3	l_4	c	r
Series 1	Series 2	min.						min.		max.
6		12	20	10	6	5,5	M3	5	1	1
	8	14	22	11		7,5	M4	7		
10		16	25	12,5	8	9	M5	8		
	12	19	28	14		11	M6	10		
	14	21	30	15		13				
16		23	32	16	10	15	M8	13		
	20	27	36	18		19	M10	16		
25		32	40	20		24	M12	20		
NOTE Parameter d_4 : see clause 6.										

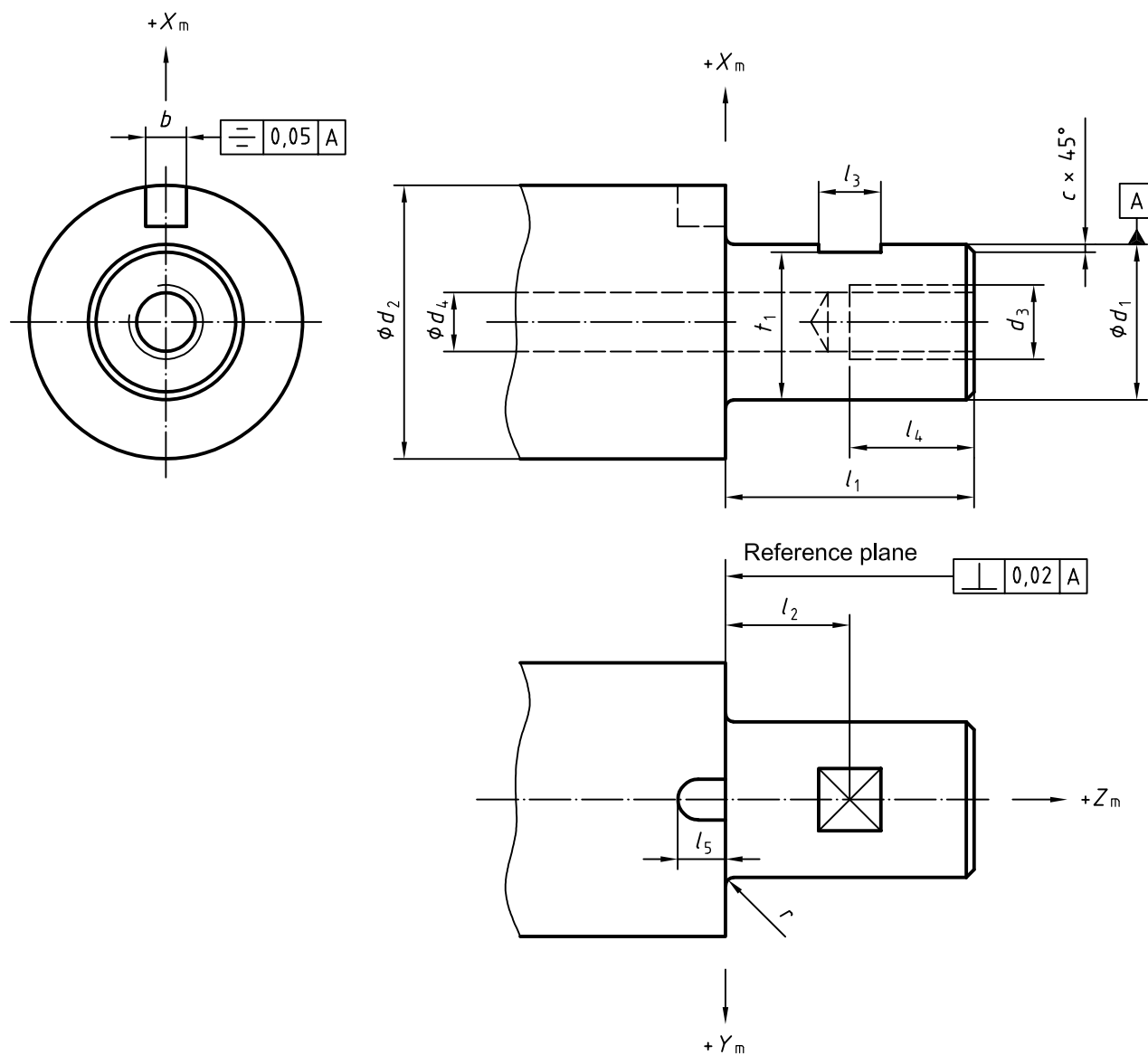


Figure 2 — Basic layout of the shaft mechanical interface Type 2

Table 2 — Preferred series 1 and supplementary series 2 of the shaft mechanical interface Type 2

Shaft diameter		Reference plane diameter	Shaft length	Flat surface			Internal thread		Chamfer	Round-ing	Slot		
				Location	Length	Height	Nominal diameter	Depth			Width	Depth	Height
d_1 h7		d_2	l_1	l_2	l_3	t_1	d_3	l_4	c	r	b Js9	l_5	t_2
Series 1	Series 2	min.								max.		min.	max.
6		15	20	10	6	5,5	M3	5	1	1	3	4,5	4
	8	17	22	11		7,5	M4	7					5
10		22	25	12,5	8	9	M5	8			4	6	7
	12	24	28	14		11	M6	10					8
	14	26	30	15		13							
16		34	32	16	10	15	M8	13			6	9	11
	20	38	36	18		19	M10	16					13
						24	M12	20					16
25		44	40	20									
NOTE Parameter d_4 : see clause 6.													

Bibliography

- [1] ISO 261:1998, *ISO general-purpose metric screw threads — General plan*

(Continued from second cover)

<i>International Standard</i>	<i>Corresponding Indian Standard</i>	<i>Degree of Equivalence</i>
ISO 9409-1 : 1996 ¹⁾ Manipulating industrial robots — Mechanical interfaces — Part 1: Plates	IS 13547 (Part 1) : 2010 Manipulating industrial robots — Mechanical interfaces: Part 1 Plates	Identical

The technical committee has reviewed the provision of the following International Standard referred in this adopted standard and has decided that it is acceptable for use in conjunction with this standard:

<i>International Standard</i>	<i>Title</i>
ISO 9787 : 1999	Manipulating industrial robots — Coordinate systems and motion nomenclatures

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

¹⁾ Since revised in 2004.

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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